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(12) **United States Patent**
Schmeichel et al.

(10) **Patent No.: US 9,421,900 B2**
(45) **Date of Patent: *Aug. 23, 2016**

(54) **ROLL-UP TARP CONVERSION KIT AND METHODS OF USE**

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(73) Assignee: **Agri-Cover, Inc.**, Jamestown, ND (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/617,345**

(22) Filed: **Feb. 9, 2015**

(65) **Prior Publication Data**

US 2015/0151663 A1 Jun. 4, 2015

Related U.S. Application Data

(63) Continuation of application No. 13/901,102, filed on May 23, 2013, now Pat. No. 8,985,669.

(60) Provisional application No. 61/651,309, filed on May 24, 2012.

(51) **Int. Cl.**

B60P 7/04	(2006.01)
B60J 7/08	(2006.01)
B23P 6/00	(2006.01)

(52) **U.S. Cl.**

CPC ... ***B60P 7/04*** (2013.01); ***B23P 6/00*** (2013.01); ***B60J 7/085*** (2013.01); *Y10T 29/49716* (2015.01)

(58) **Field of Classification Search**

CPC B60J 7/068; B60J 7/085; B60J 11/02
USPC 296/98
See application file for complete search history.

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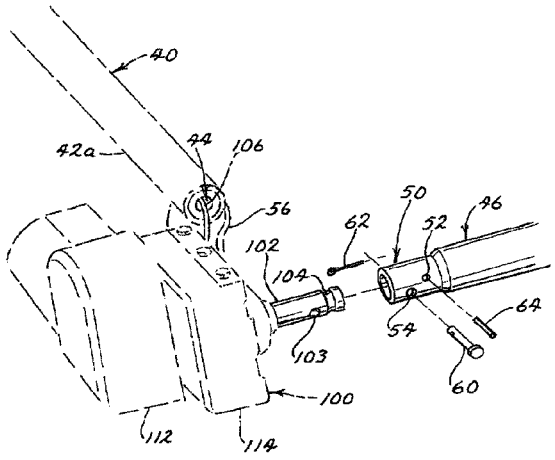
(74) *Attorney, Agent, or Firm* — Moore & Hansen, PLLC; Robert C. Freed

(57) **ABSTRACT**

A motorized conversion kit for converting manually operated roll tarps includes front and rear arm assemblies and a roll tube extension. The front arm assembly includes a drive assembly that drives an output shaft. The output shaft is removably connectable to the roll tube extension that is connected to a modified roll tube. The connection between the output shaft and the roll tube extension has two distinct modes. The output shaft can be removably connected to the roll tube extension with a clevis pin such that the output shaft and the roll tube extension rotate together or the output shaft can be retained within the roll tube extension by a roll pin residing in a peripheral grove in the output shaft so that the output shaft may rotate independently of the roll tube extension. Methods of installing and using the conversion kit are also disclosed.

20 Claims, 12 Drawing Sheets



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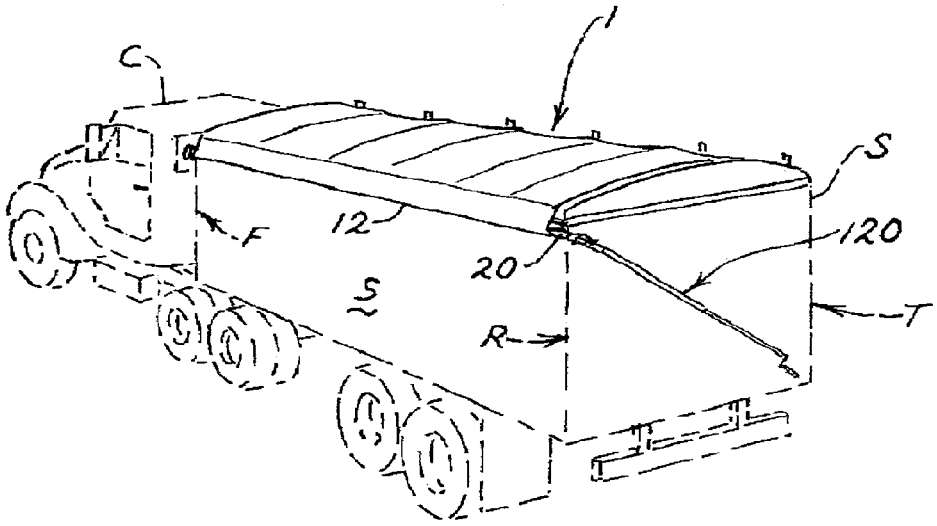

FIG. 1A
PRIOR ART

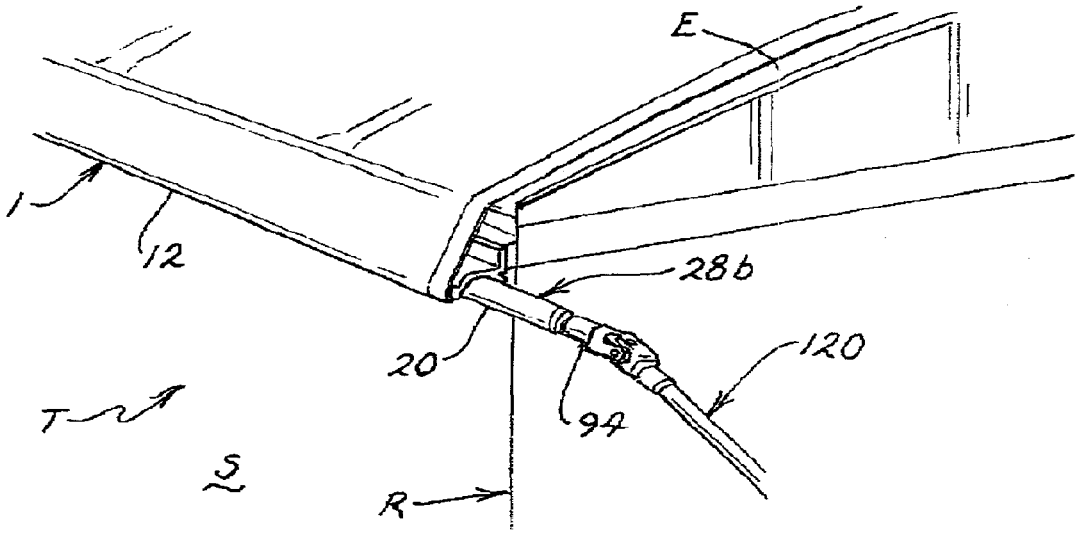

FIG. 1B
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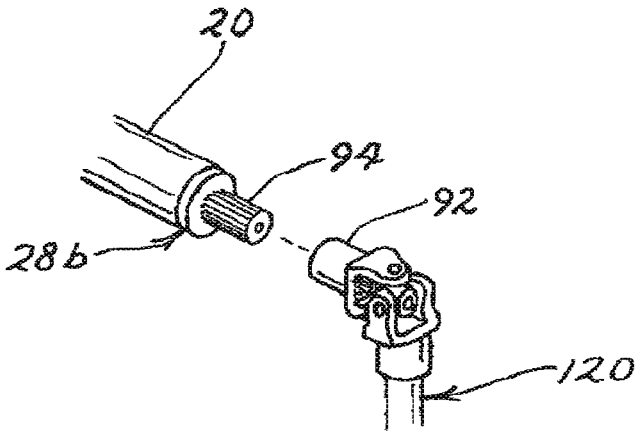


FIG. 1C
PRIOR ART

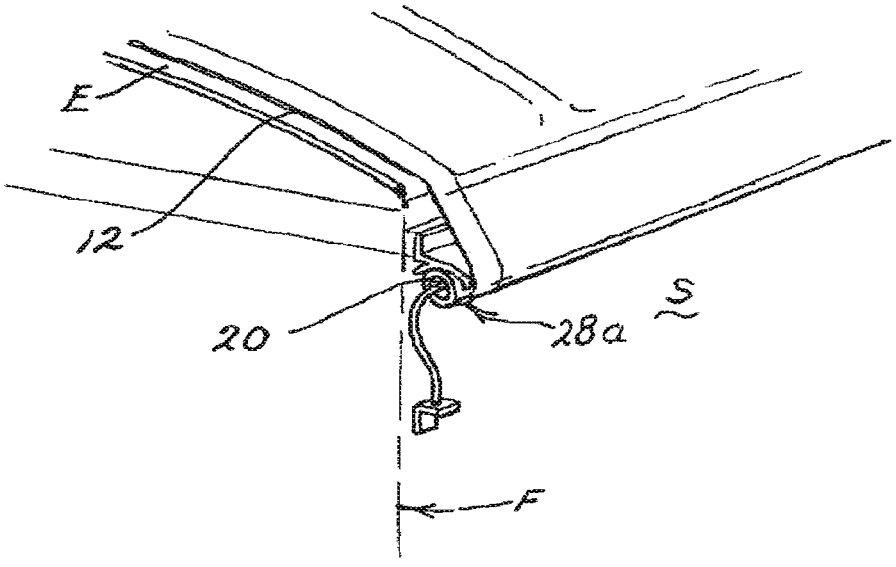
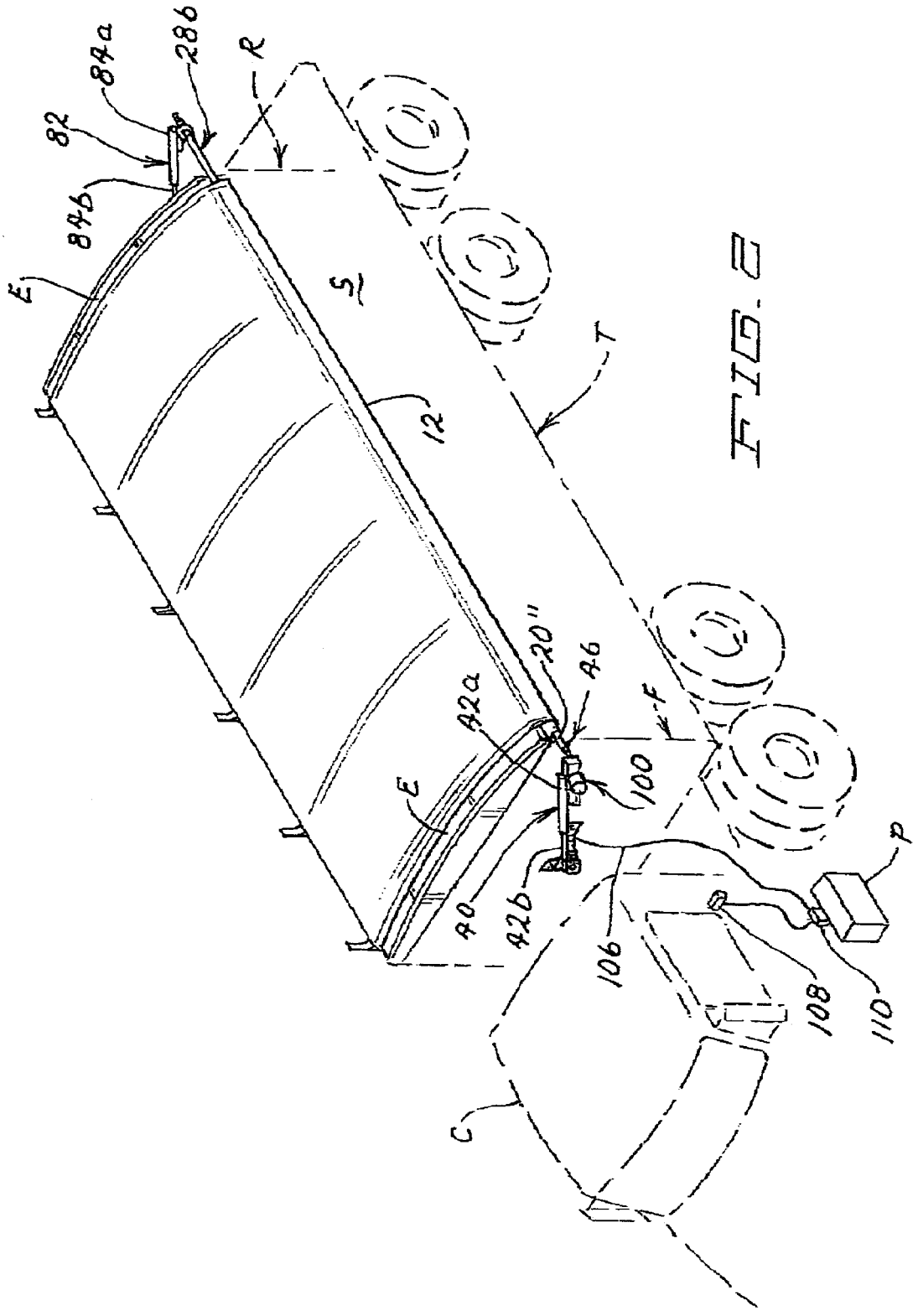


FIG. 1D
PRIOR ART



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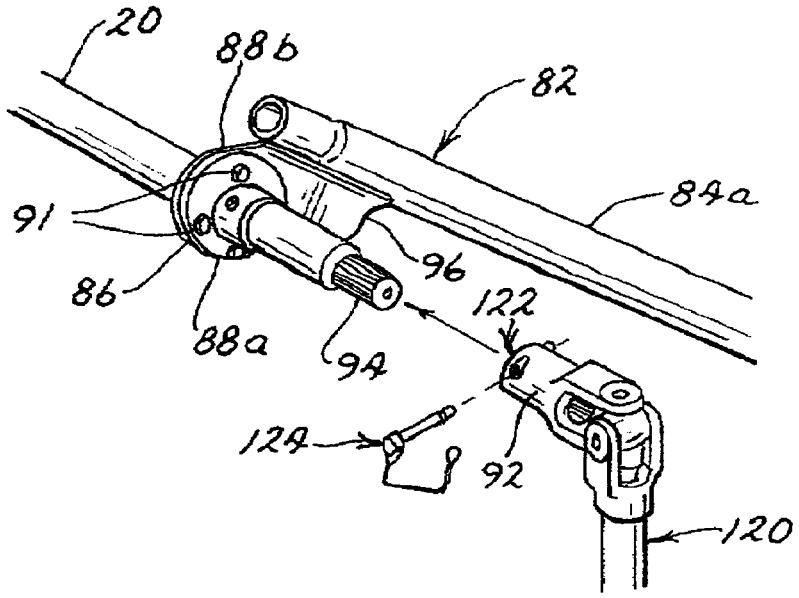
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84a
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88a
96
94
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92
120

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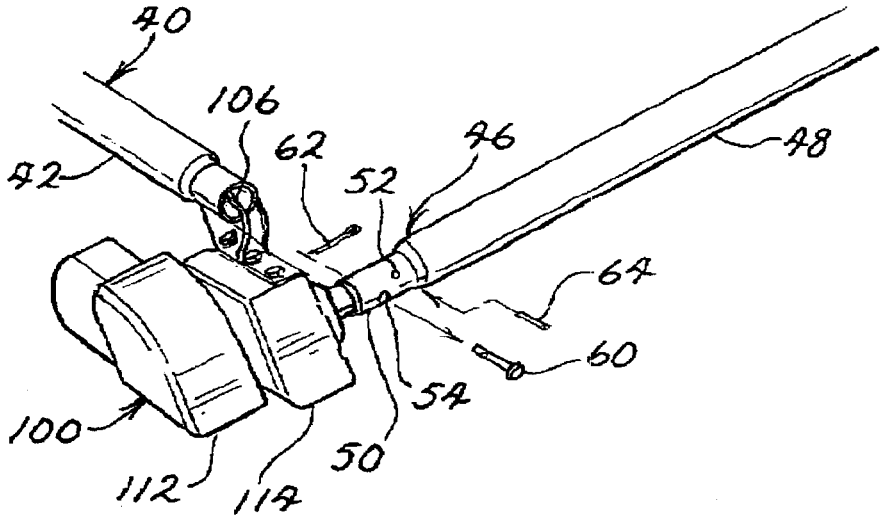
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64
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54
100
112
114
50

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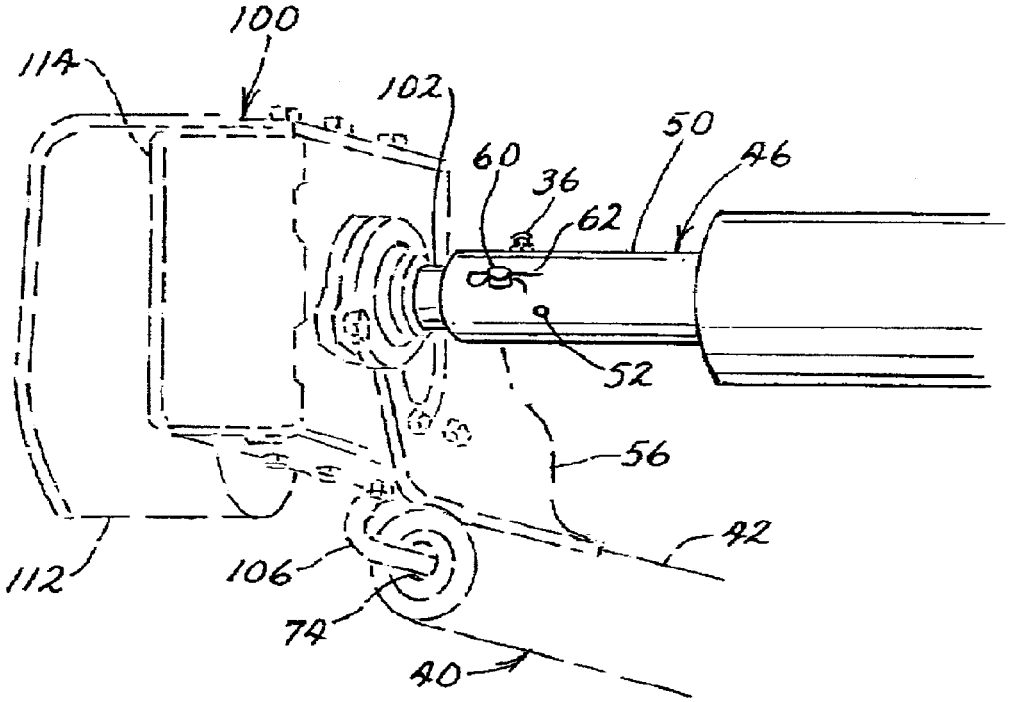
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114
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36
62
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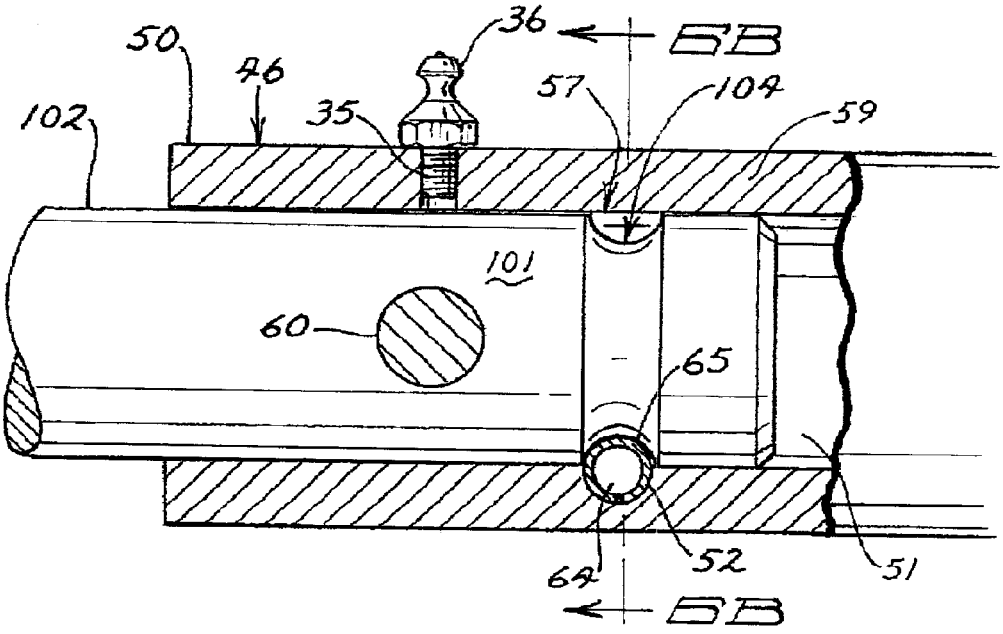
52
56
42
112
106
74
40

FIG. 5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51
6B

FIG. 6A

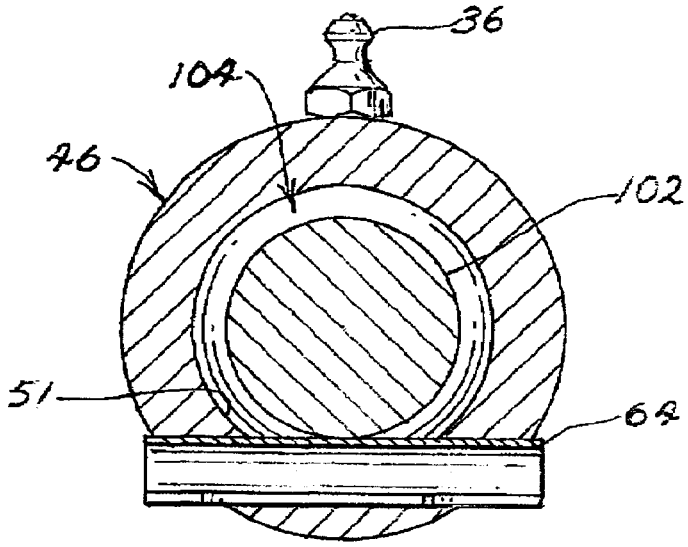


FIG. 6B

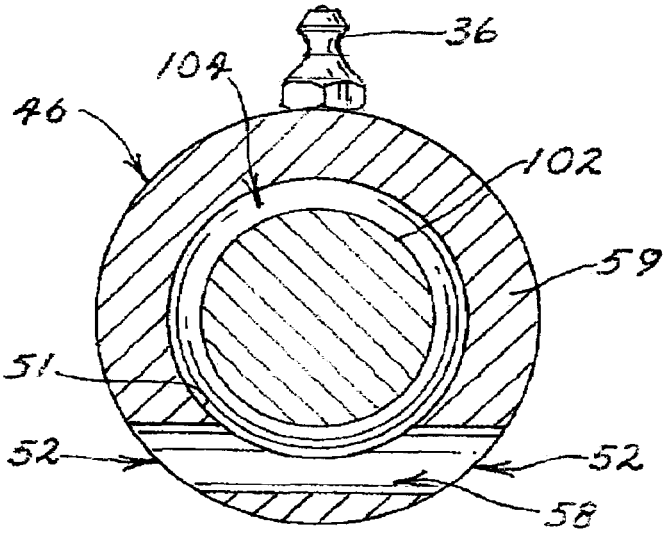


FIG. 6C

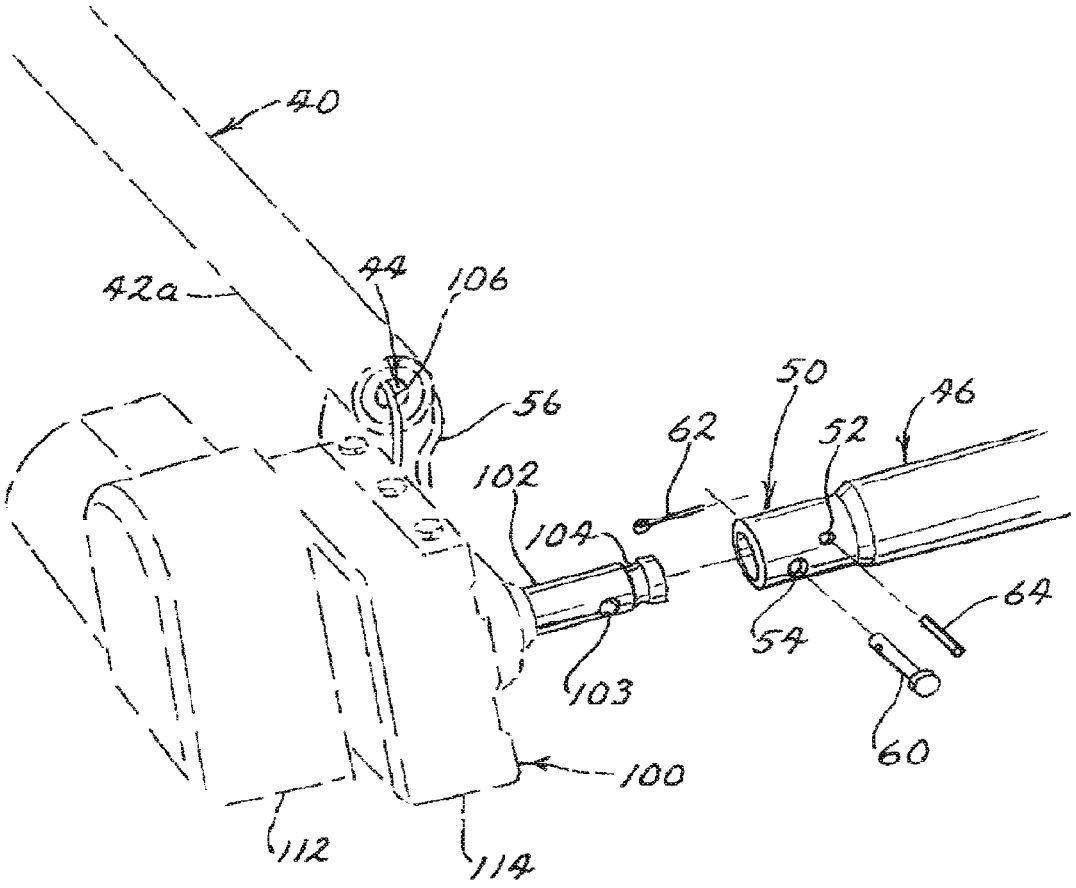


FIG. 7

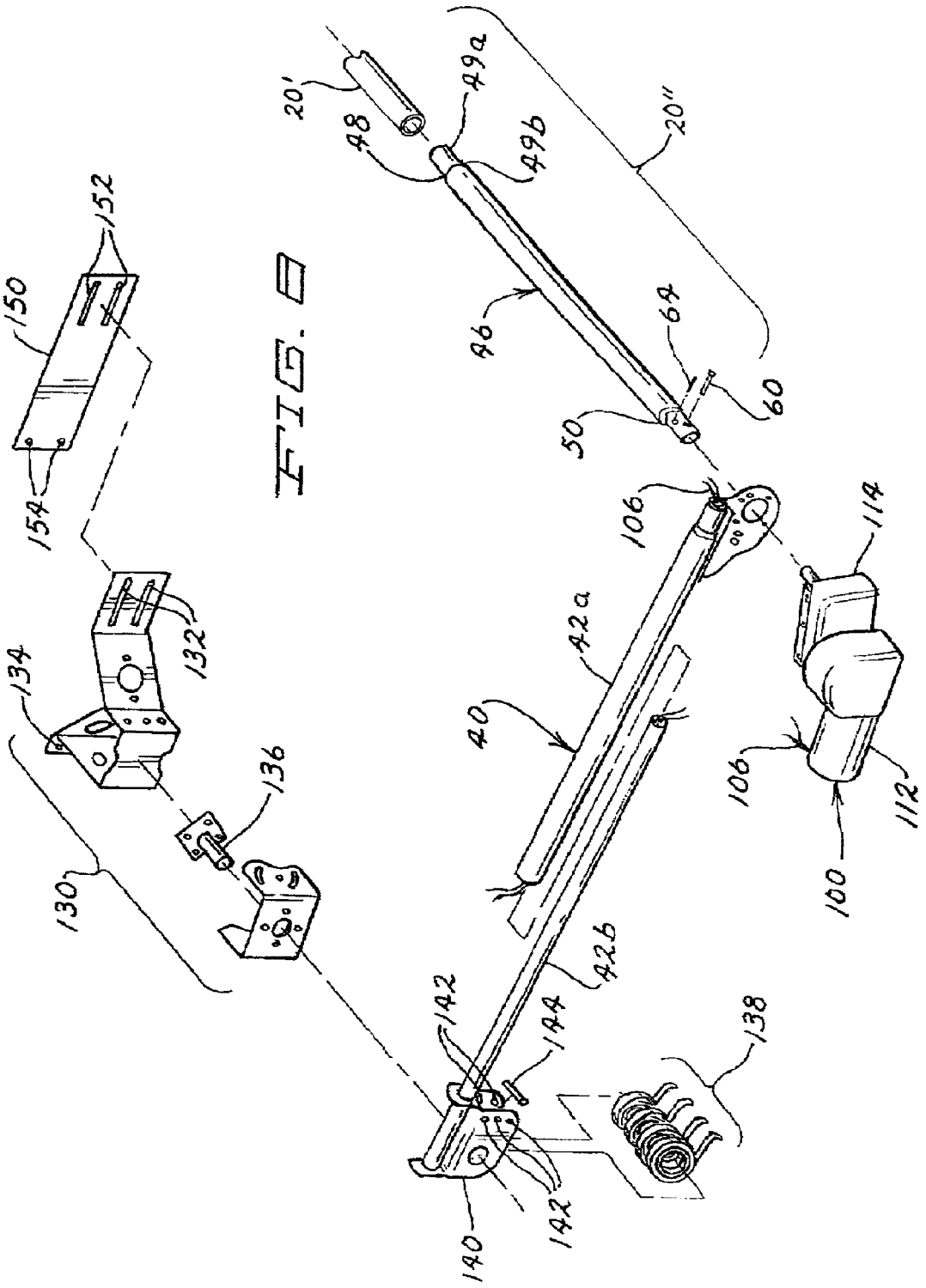
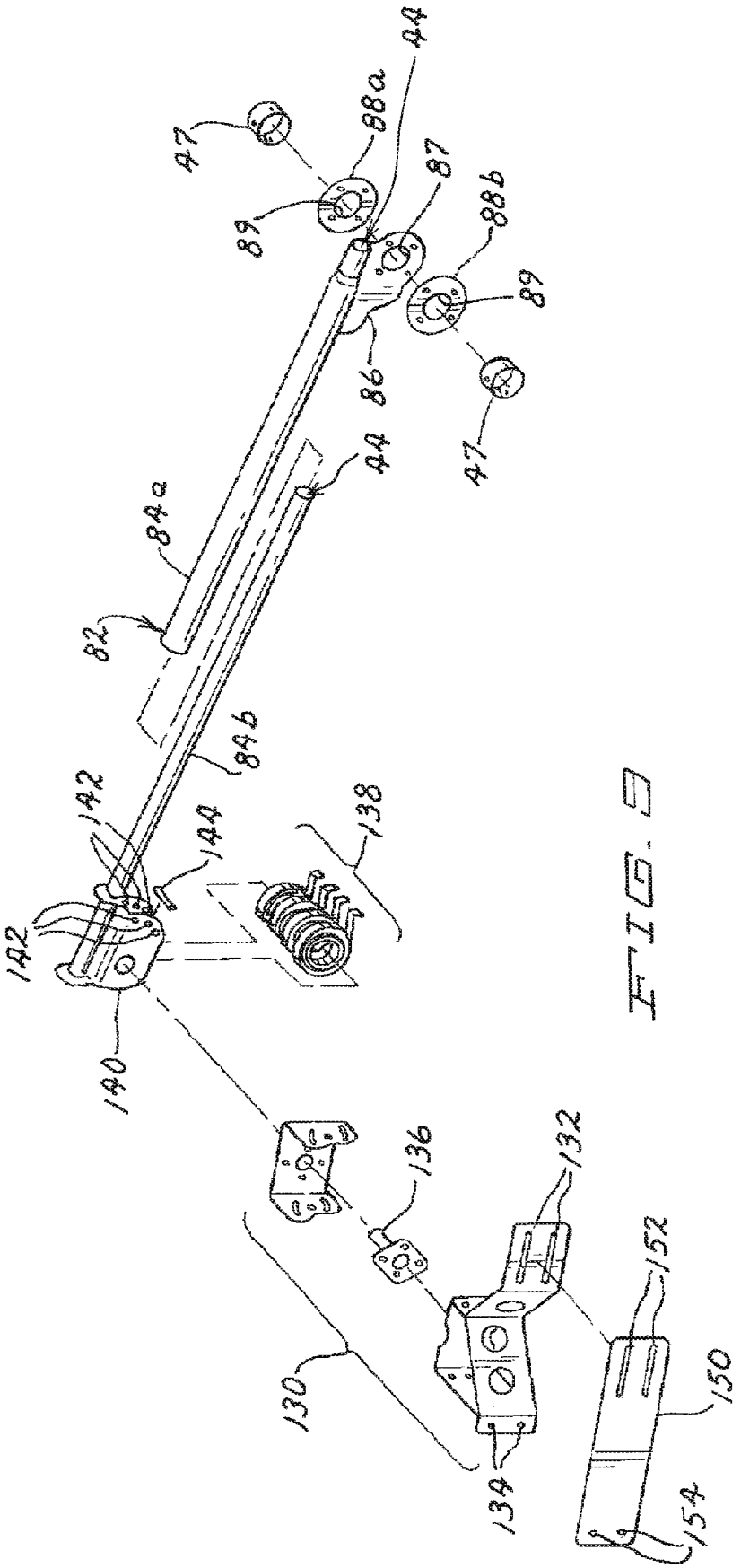


FIG. 8
20'
48
49a
49b
20"
46
64
60
50
106
114
42a
40
106
112
100
42b
142
144
138
142
140
130
136
134
132
154
150
152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88a
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88b
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89
86
47
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84a
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152
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134
154

FIG. 5

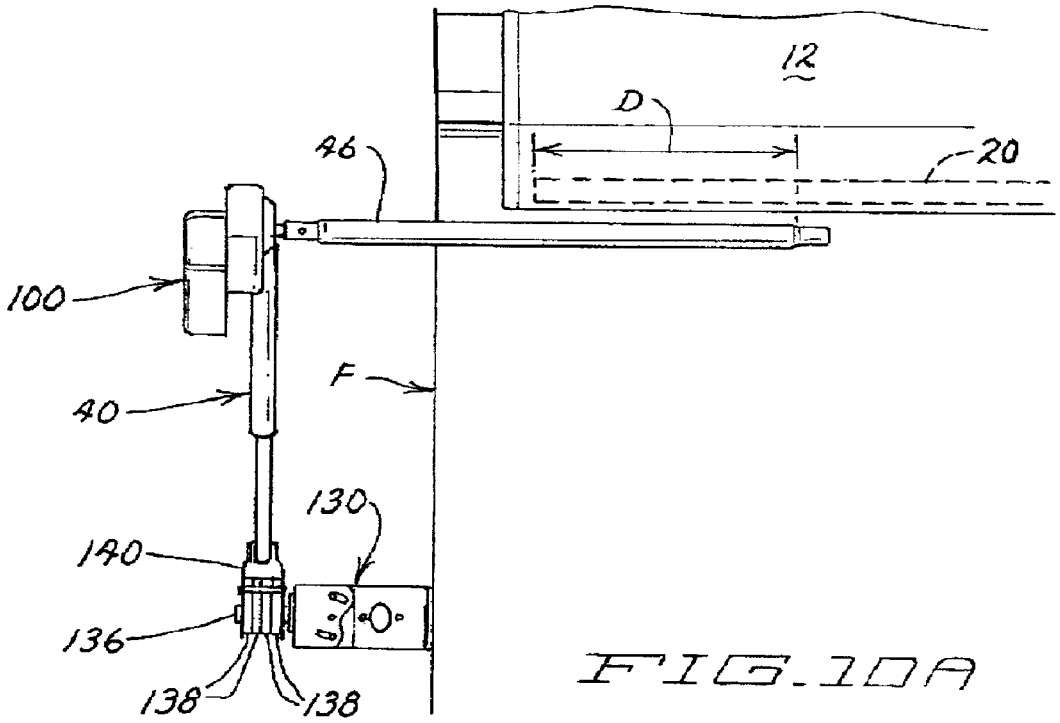

FIG. 10A

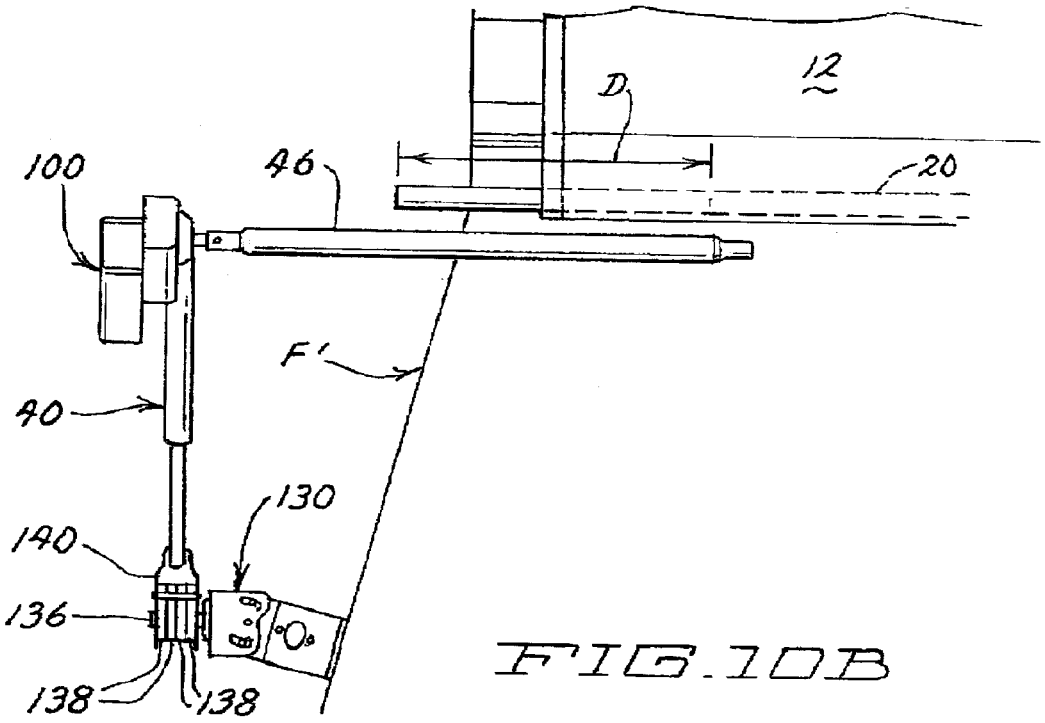

FIG. 10B

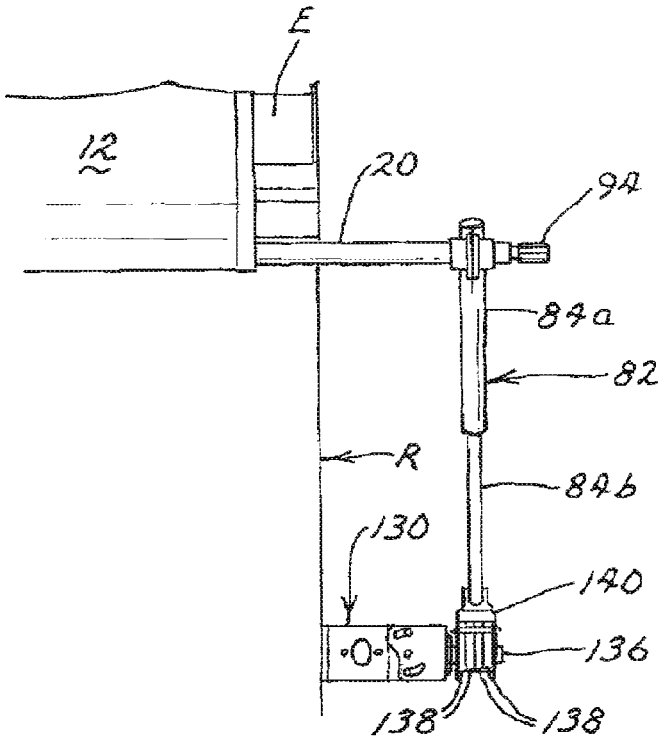

FIG. 11A

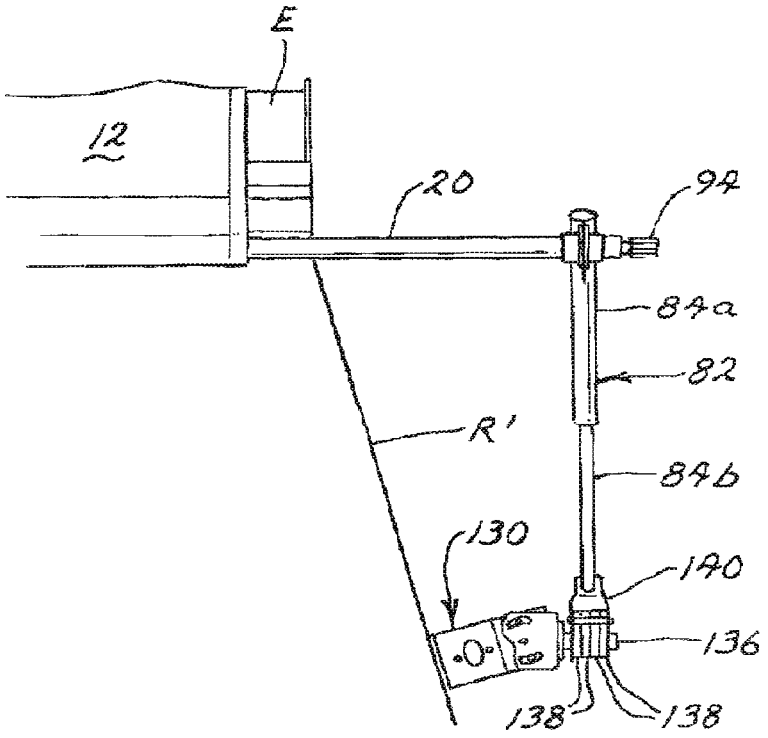

FIG. 11B

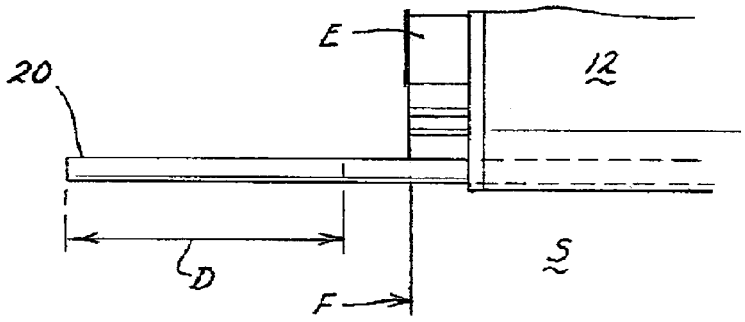

FIG. 12

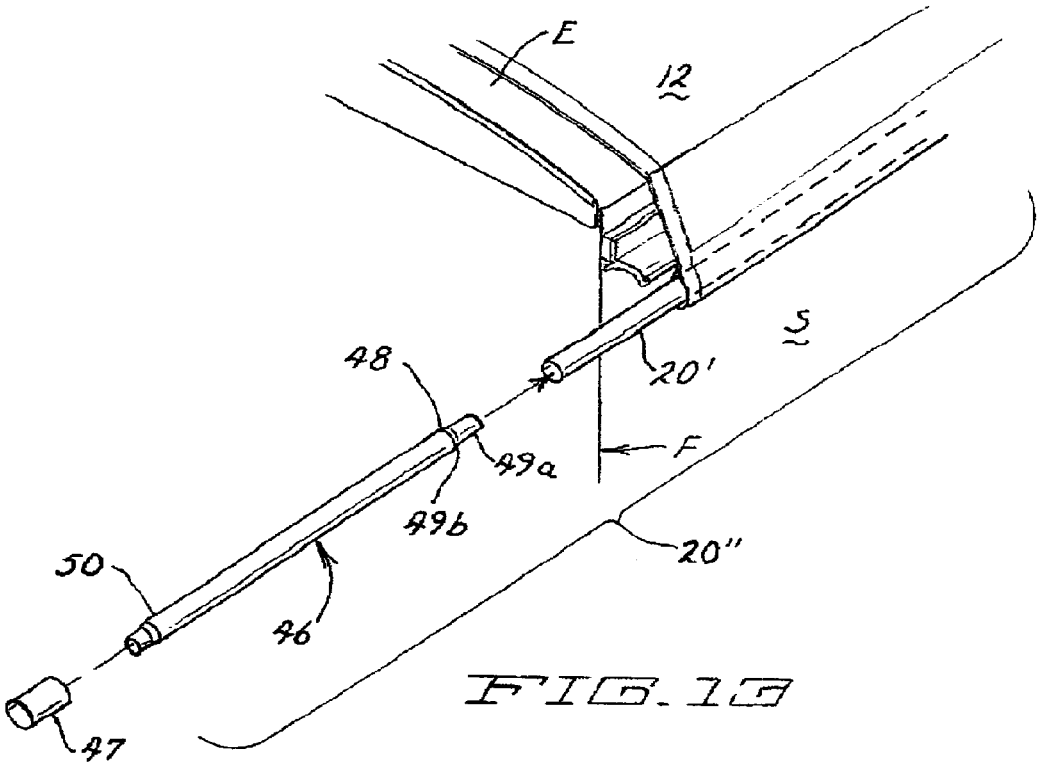

FIG. 13

ROLL-UP TARP CONVERSION KIT AND METHODS OF USE

RELATED APPLICATIONS

The present application is a continuation of U.S. patent application Ser. No. 13/901,102, filed May 23, 2013, which claimed the benefit under 35 U.S.C. 119(e) of U.S. provisional application Ser. No. 61/651,309, filed May 24, 2012, each of which is hereby incorporated herein by reference.

FIELD OF THE INVENTION

Conversion kits and methods of the present invention can be used to convert a manually operated roll-up tarp apparatus to a motorized roll-up tarp apparatus. Various preferred embodiments of the present invention can be used to convert a manually operated roll-up tarp apparatus in a manner that allows the converted roll-up tarp to operate either as a motorized apparatus or a manually operated crank apparatus, as desired or needed. Methods of installing and using the conversion kit are also disclosed.

BACKGROUND OF THE INVENTION

Roll-up tarp assemblies for covering truck cargo boxes having an open top are widely utilized in the trucking industry for transporting grain and other commodity products. For example, U.S. Pat. No. 4,505,512 (Schmeichel et al.) discloses a roll-up tarp apparatus for an open truck box or trailer. The roll-up tarp assembly includes a tarp made from a flexible material. The tarp is secured along one side to the open top of the truck box. The other side of the tarp is attached to a tubular member with a plurality of flexible straps. A crank apparatus connected to the tubular member by a U-joint and collar assembly is utilized to roll the tubular member transversely of the truck box opening so as to selectively cover the open top truck box with the tarp or uncover the open top truck box. A plurality of hooks are attached to the side of the truck box opposite of the side to which the tarp is fixedly secured. The hooks retain the tubular member when the tarp is covering the truck box. Other known roll-up tarp assemblies utilize a hand crank mechanism to control the movement of the tubular member, but the general trend is to utilize a motorized arm that is interconnected to the tubular member to minimize the work needed to open and close the truck box and to simplify that activity.

In motorized or motor driven roll-up tarp assemblies, a biasing member can be used to assist the motor in moving the tubular member in an unroll direction. Typically, a bungee cord is interconnected to a collar located on the tubular member and the bungee cord extends from the collar, around a corner of the truck box and along at least part of the length of the truck box where the second end of the bungee cord is attached. As the tarp rolls up on the tubular member or unrolls from the tubular member, front and rear arms guide the tubular member across the top of the truck box that frames the top opening and supports the tarp over the top opening of the truck box.

Other well known roll-up tarp assemblies include springs and other mechanisms to bias the arms in the unroll direction. See, for example, U.S. Pat. No. 7,188,887 (Schmeichel) and U.S. Pat. No. 7,195,304 (Schmeichel).

The present invention addresses limitations and problems associated with the related art.

SUMMARY OF THE INVENTION

Conversion kits and disclosed methods of the present invention can be used to convert a manually operated roll-up tarp apparatus to a motorized or motor driven roll-up tarp apparatus. In further preferred embodiments, the roll-up tarp apparatus can be used either as a motorized apparatus or a manually cranked apparatus, as desired or required. Preferred methods for installing and using the conversion kit are also disclosed.

In accordance with an aspect of the invention, a conversion kit may include a front arm assembly and a rear arm assembly. The front arm assembly may include an upper arm and a lower arm that may be telescopically connected to each other. Alternatively, the front arm assembly may include an upper arm that may be telescopically connected to an existing lower arm. A drive assembly may be connected to the upper arm. The drive assembly may include a motive source that is operatively connected to, and which is able to rotate an output or drive shaft. The output shaft may be removably connectable to a roll tube extension that is connected to an existing tarp roll tube or roll tube. Advantageously, the connection between the output shaft and the roll tube extension feature two distinct modes of attachment that result in two distinct operational modes. In a first mode, output shaft may be removably connectable to one end of an extension such the output shaft and the extension rotate together. In the first mode of operation, a transverse clevis pin that extends through both the output shaft and the extension may be used to secure the output shaft to the extension. In a second mode, the output shaft is rotatably retained by the extension, so that the output shaft may rotate freely with respect to the extension to which it is attached when the clevis pin is not engaged with the output shaft and the roll tube extension. In the second mode of operation, a first pin, preferably a roll pin, engages a portion of a peripheral groove of the output shaft and a portion of the extension may be used to rotatably retain the output shaft to the extension. In both modes of operation, a second end of the extension may be connected to a roll tube of an existing tarp system. The front arm assembly may also include elements such as a lower bracket assembly with which to connect the lower arm to a truck body, and one or more biasing elements that may be configured and arrange to bias the front arm assembly towards one side of a truck body. Preferably, the front arm is biased in the unroll direction.

In accordance with another aspect of the invention, a rear arm assembly of the conversion kit is largely similar to the front arm assembly of the kit, in that it may include an upper arm that may be telescopically connected to a lower arm, and it may include elements such as a lower bracket assembly with which to connect the lower arm to a truck body, and one or more biasing elements that may be configured and arranged to bias the rear arm assembly toward one side of a truck body. Preferably, the rear arm is biased in the unroll direction. However, the rear arm assembly does differ from the front arm assembly in several important respects. The main differences are that the rear arm assembly does not include a drive assembly that is connected to an upper arm by a bracket, or a roll tube extension that operatively connects a tarp roll tube to the drive assembly. Instead, the upper arm of the rear arm assembly includes a bracket that rotatably is configured and arranged to rotatably support an existing roll tube. In an exemplary embodiment, the bracket may be provided with an aperture that is sized to rotatably receive an end of a roll tube. In some embodiments, the aperture of the bracket may be provided with a friction reducing surface that facilitates rotation of the roll tube relative to the rear arm assembly. The bracket may be configured so that it allows a splined end of an existing roll tube to project beyond one end thereof. This allows the splined end of the roll tube to be engaged by a splined socket of a manually operable hand

crank, should the drive assembly of the front arm assembly be disconnected or otherwise rendered inoperable. Both of the front and rear arm assemblies are preferably connected to respective sides of the truck box and are spring biased in the unroll direction.

Should a tarp assembly need to be operated manually after the conversion kit is installed, perhaps due to motor or power failure, the preferred conversion kit is arranged and configured to also be used as a manual assembly. By removing the clevis pin, the modes of operation may be changed and the motive source effectively disabled, wherein the roll tube can turn freely such that a crank handle can be then attached to the splined end at the rear end of the elongated roll tube to operate the assembly to roll and unroll the flexible tarp as needed. To secure the output shaft of the drive assembly to the roll tube extension in this crank mode, a roll pin or the like can be inserted into a groove within the output shaft via an aperture in the roll tube extension.

In a further aspect of the invention, the conversion kit is for converting a manually operated roll-up tarp assembly to a motor driven roll-up tarp assembly. The manually operated roll-up tarp assembly preferably including a flexible tarp and a roll tube upon which the flexible tarp can be gathered and from which the flexible tarp can be unfurled when the flexible tarp is gathered upon the roll tube. The roll tube having a first length and first and second ends and the first end including a splined connecting member. Preferably, the roll tube is modified by removing a portion of the roll tube proximate the second end to form a modified roll tube that has a second length; wherein the second length is shorter than the first length. The conversion kit to be installed preferably includes a first arm assembly including a motor having an output shaft, wherein the output shaft has an outer surface and the outer surface includes a groove; a first pin; a roll tube extension for attachment to the modified roll tube; the roll tube extension having first end and second ends and an inner surface that defines a hollow interior proximate the first end; the first end being constructed and shaped so that the first end can slide onto the output shaft to become connected therewith, and the second end being connectable to the modified roll tube so as to be an extension thereof when connected thereto; wherein the roll tube extension further includes a first aperture that can be aligned with the groove when the roll tube extension is connected with the output shaft such that the first pin can be inserted into the first aperture and the groove such that the roll tube extension is engaged with the output shaft and cannot be disengaged therefrom, but wherein the roll tube extension and the first pin can rotate around the output shaft independent thereof when the first pin resides at least partially in the groove.

In a preferred embodiment, the conversion kit further includes a clevis pin; wherein the output shaft further includes a pin aperture; and wherein the roll tube extension further includes a set of two of second apertures that can be aligned with the output shaft in such a manner that the set of two of second apertures can receive the clevis pin and the clevis pin can pass through the pin aperture and both of the set of two second apertures to secure the roll tube extension to the output shaft so that the extension tube will turn with the output shaft when the clevis pin is secured in the set of two of second apertures and the pin aperture.

In preferred embodiments, the conversion kit further includes a clevis pin, the output shaft further includes a pin aperture and the roll tube extension further includes a set of two of second apertures that can be aligned with the output shaft in such a manner that the set of two of second apertures can receive the clevis pin and the clevis pin can pass through both of the two second apertures and the pin aperture to secure the roll tube extension to the output shaft so that the extension tube will turn with the output shaft when the clevis pin is secured in the set of two of second apertures and the pin aperture. In various embodiments, the clevis pin is inserted into the two second apertures and the pin aperture to secure the roll tube extension to the output shaft so that the extension tube will turn with the output shaft.

In a further embodiment, when the crank arm from the manually operated roll-tarp assembly is retained, the method can further comprise the step of removing the clevis pin from the two second apertures and the pin aperture to permit the roll tube extension to freely rotate about the output shaft so that the roll tube can turn independently of the output shaft so that the crank arm can be connected to the splined connecting member on the first end to turn the roll tube and either gather or unfurl the flexible tarp.

A further aspect of the present invention is a method of converting a manually operated roll-up tarp assembly having a crank arm, to a motor driven roll-up tarp assembly. The preferred method comprises the steps of: 1) providing a roll-up tarp conversion kit including: a first arm assembly including a motor having an output shaft, wherein the output shaft has an outer surface and the outer surface includes a groove; a first pin; a roll tube extension for attachment to the modified roll tube; the roll tube extension having first and second end segments and an inner surface that defines a hollow interior proximate the first end segment; the first end segment being constructed and shaped so that the first end segment can slide onto the output shaft to become connected therewith, and the second end segment being connectable to the modified roll tube so as to be an extension thereof when connected thereto; wherein the roll tube extension further includes a first aperture that can be aligned with the groove when the roll tube extension is connected with the output shaft such that the first pin can be inserted into the first aperture and the groove such that the roll tube extension is engaged with the output shaft and cannot be disengaged therefrom, but wherein the roll tube extension and the first pin can rotate around the output shaft independently thereof when the first pin resides at least partially within the groove; 2) making certain a predetermined measurement to determine where to position a cut on along the greatest length of the roll tube to achieve a desired result; 3) cutting off a portion of the elongated roll tube at the determined position so as to shorten the elongated roll tube as desired to form a modified elongated roll tube; 4) securing the second end segment of the roll tube extension to the modified elongated roll tube; 5) securing the first arm assembly to the truck box; 6) securing the first end segment of the roll tube extension to the output shaft; and 7) forcing the first pin into the first aperture so that the first pin resides at least partially within the groove so that the first pin can prevent the roll tube extension from disengaging from the output shaft, but such that the roll tube extension can rotate freely about the output shaft.

These and various other advantages and features of novelty which characterize the present invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages and objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described exemplary embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, in which corresponding reference numerals and letters indicate corresponding parts of the various

embodiments throughout the several views, and in which the various embodiments generally differ only in the manner described and/or shown, but otherwise include corresponding parts;

FIG. **1**A is a partial, perspective view of a trailer truck C including a tractor trailer T having a conventional hand crank-operated tarp assembly **1** attached thereto, all of which can be found among prior art trailer trucks;

FIG. **1**B is a partial, enlarged view of a rear corner of the prior art trailer T of FIG. **1**A illustrating a crank arm **120** operatively connected to a spline **94**;

FIG. **10** is a partial, exploded view of the prior art crank arm **120** of FIGS. **1**A-**1**B showing the pivotal connector **92** disconnected from the spline **94**;

FIG. **1**D is a partial, enlarged view of a front corner of the prior art trailer T of FIG. **1**A;

FIG. **2** is a partial, perspective view of a preferred conversion kit assembly **38** operatively secured to the trailer truck T of FIG. **1**;

FIG. **3** is an enlarged, partial perspective view of a portion of the conversion kit assembly **38** of FIG. **2** illustrating the cooperative engagement between a bracket **86** on the upper arm of a rear arm assembly **82** and a splined end of the roll tube **20**, wherein the splined end of the roll tube is rotatably retained by the bracket of the rear arm assembly;

FIG. **4** is an enlarged, partial perspective view of the front end of the conversion kit assembly **38** of FIG. **2**, showing a portion of the front arm assembly **40** in which preferred pins for variously securing the roll tube extension **46** to the output shaft **102** of a drive assembly or motor **100** are shown in exploded view for clarity;

FIG. **5** is an enlarged, partial perspective view of a drive assembly or motor **100** of a front arm assembly **40** of the conversion kit **38** of FIG. **2**; the drive assembly **100** including an output shaft **102** that is operatively connected to the first end segment **50** of the roll tube extension **46**;

FIG. **6**A is an enlarged, partial cross-sectional view of the operative connection between the output shaft **102** of the drive assembly **100** and the roll tube extension **46** of the conversion kit **38** of FIGS. **2** and **4**;

FIG. **6**B is a partial, cross-sectional view of the output shaft **102** and the roll tube extension **46**, as seen from the line **6**B-**6**B of FIG. **6**A, but where the portion of the roll tube extension **46** removed in the cross-sectional view shown in FIG. **6**A is restored to show the full cross-sectional view of the roll tube extension **46** and the output shaft **102**, wherein the roll tube extension **46** has a groove **58** shown in FIG. **6**B in which pin **64** resides, as shown;

FIG. **6**C is a partial, cross-sectional view similar to that shown in FIG. **6**B, but where the cross-section of the pin **64** is removed to show the groove **58** in the interior surface **51** of the roll tube extension **46** in which the pin **64** resides in FIGS. **6**A and **6**B;

FIG. **7** is a partial, exploded perspective view illustrating the cooperative engagement between the drive assembly **100** and the roll tube extension **46** of FIGS. **2**-**6** in which the application of a clevis pin **60** and a securing device or cotter pin **62** can form one operative connection and in which the application of a roll pin **64** can form another operative connection;

FIG. **8** is a partial, exploded perspective view of an exemplary front arm assembly **40** of the conversion kit **38** of FIGS. **2**-**7**;

FIG. **9** a partial, exploded perspective view of an exemplary rear arm assembly **82** of the conversion kit **38** of FIG. **2**;

FIG. **10**A is an end elevation of a front arm assembly **40** as it may be connected to a vertical front wall F of a truck trailer;

FIG. **10**B is an end elevation of a front arm assembly **40** as it may be connected to a slanted front wall F' of a truck trailer;

FIG. **11**A is an end elevation of a rear arm assembly **82** as it may be connected to a vertical rear wall R of a truck trailer;

FIG. **11**B is an end elevation of a rear arm assembly **82** as it may be connected to a slanted rear wall R' of a truck trailer;

FIG. **12** is a partial end elevation of roll tube **20** that has been partially drawn out of tarp **12** such that a portion of the roll tube **20** can be removed to form a modified roll tube **20'** for installation of the conversion kit **38** of FIG. **2**; and

FIG. **13** is a partial, exploded perspective view of a roll tube extension **46** and a portion of a modified roll tube **20'** illustrating how the roll tube extension **46** can be connected to the modified roll tube **20'** to form an extended modified roll tube **20"** by joining the roll tube extension **46** to the modified roll tube **20'** during installation of the conversion kit **38** of FIG. **2**.

DETAILED DESCRIPTION

Referring now to the drawing figures, a prior art trailer truck having a crank operated roll tarp assembly **1** is illustrated in FIGS. **1**A-**1**D. The trailer T includes a box opening (not shown; obstructed by tarp **12**, which covers the box opening in FIG. **1**A), a front end F, a rear end R and two lateral sides S. The crank operated tarp assembly **1** includes a flexible cover or tarp **12** secured to a roll tube **20**. One end of the flexible tarp **12** is secured to one lateral side S and the other end is connected to the elongated roll tube **20**. The roll tube **20** will preferably include a splined connecting member or spline **94**, preferably proximate the rear end R of the trailer T and a crank arm **120**, preferably connected to the roll tube **20** proximate the rear end R of the trailer T.

Referring now also to FIGS. **2**-**13**, the preferred conversion kit **38** of the present invention is effective to transform such a manually operated roll tarp assembly having a manually powered crank arm **120**, as illustrated in FIGS. **1**A-**1**D into a motorized tarp assembly. Preferred embodiments of the conversion kit **38** are illustrated in FIGS. **2**-**13** and discussed further below.

Typical prior art manually operated tarp assemblies include a flexible cover **12** that is secured to a truck box T and also to an elongated roll tube **20** having first and second ends **28***b*, **28***a*, wherein the second end **28***a* is generally connected to the truck box T and the first end **28***b* is generally connected to a crank arm assembly **120** having a pivotal connector **92** for connection to the spline **94** or the like.

Preferred conversion kits **38** of the present invention will include a front arm assembly **40**, a rear arm assembly **82**, a roll tube extension **46**, and lower bracket assemblies **130**. A preferred embodiment of the front arm assembly **40** will include an upper arm portion **42***a* telescopically connected to a lower arm portion **42***b* and a drive assembly **100** connected to the upper arm **42***a* by a bracket **56**. The drive assembly **100** can be interconnected to a roll tube extension **46** that can be attached to a modified roll tube **20'** that is made by shortening the roll tube **20** of an existing tarp system such as tarp system **1** of FIGS. **1**A-**1**D.

The preferred roll tube extension **46** has first and second end segments **50**, **48**. The second end segment **48** may be connected to a modified roll tube **20'** after the modified roll tube is made by shortening an existing roll tube **20**, and such that the roll tube extension is in axial alignment therewith and joined thereto, preferably secured by welding the two tubes together. In some preferred embodiments, the roll tube extension **46** has a diameter that is substantially the same as the diameter of both the roll tube **20** and the modified roll tube **20'**. In some embodiments, the second end segment **48** of the roll

tube extension **46** may be provided with an axially aligned stub **49***a* and a shoulder **49***b*, with the stub **49***a* configured to be inserted into one end of the modified roll tube **20'** (see, in particular, FIG. **13**). In some embodiments, the roll tube extension **46** may be secured to the modified roll tube **20'** by welding. Alternatively, adhesives or conventional fastening elements such, as set screws, clamps, brackets and/or nuts and bolts can be used to secure the stub **49***a* to the modified roll tube **20'**. In some embodiments, the roll tube extension **46** may include a protective sleeve **47** that may be positioned about the exterior of a portion of the extension **46**. The protective sleeve **47** serves to protect the extension **46** and prevents wear thereof by making it easier for the extension **46** to travel over an end cap E of a truck box T. In some embodiments, the protective sleeve **47** may rotate relative to the extension **46**. In a preferred embodiment, the sleeve **47** may be formed from plastic material, such as PVC tubing.

The first end segment **50** of the roll tube extension **46** may be removably connected to an output shaft **102** of the drive assembly **100** and rotatably secured thereto with a pin **64**. Referring now in particular to FIGS. **6**A-**6**C, in preferred embodiments, the pin **64** is insertable into a first aperture **52** that extends through a wall **59** of the roll tube extension **46** proximate the first end segment **50** such that at least a portion of the pin **64** is able to extend into an interior space defined in part by a circumferential, peripheral groove **104** in the outer surface **101** of the output shaft **102**. In the preferred embodiment shown in FIGS. **6**A-**6**C, the pin **64** is preferably a roll pin that can be inserted and frictionally retained within the pin aperture **52**. In preferred embodiments, the pin aperture **52** will extend transversely through the wall **59** of the roll tube extension **46**, creating a second groove **58** in the inner surface **51** of the roll tube extension **46** that extends from the pin aperture **52** on one side of the roll tube extension **46** to the pin aperture **52** on the other side of the roll tube extension **46**. In actual fact, the aperture **52** extends continuous from a fully encircled opening **52** on one side of the roll tube extension **46**, partially through the hollow interior of the roll tube extension **46** proximate the first end segment **50** and partially continuing through the wall **59** of the roll tube extension **46** in the second groove **58** formed in the wall **59** of the roll tube extension **46**, which continues to the other side of the roll tube extension **46**, where it leaves through the opposing wall **59** of the roll tube extension **46** in another fully encircled opening or aperture **52** on the opposite side. In other embodiments, there may be a plurality of radially extending apertures and a plurality of pins.

In preferred embodiments, rotation of the roll tube extension **46** with respect to the output shaft or drive shaft **102** will be enhanced through the use of lubricants. As such, preferred roll tube extensions **46** will include an access port **35** through which lubricant material may be introduced. A preferred access port **35** may include a zerk fitting **36**.

The first end segment **50** of the extension **46** may also be removably connected to an output shaft **102** of the drive assembly **100** and secured thereto with a clevis pin **60**. In some embodiments, a clevis pin **60** is removably insertable into a diametrically oriented aperture **54** of the extension **46** and through a diametrically oriented aperture **103** in the output shaft **102** of the drive assembly **100**. The clevis pin **60** serves to connect the output shaft **102** and the extension **46** together so that they can rotate together. In some embodiments, the clevis pin **60** may include an enlarged end that prevents the clevis from passing through the apertures **54** and **103**. In other embodiments, one or more ends of the clevis pin **60** may include a transverse aperture **56** that is configured to receive a cotter pin **62** used to retain the clevis pin **60** within apertures **54** and **103**.

Illustrative embodiments of a drive assembly **100** may include a motive source **112** that is operatively connected to an output shaft **102** that is connected to a roll tube **20"**. In some embodiments, a motive source **112** may be an electrical motor that may be connected to a power source P such as a primary vehicular battery or a secondary auxiliary battery, and controlled by a switch **108**. The switch **108** may be positioned in a cab "C" of a vehicle, if desired. In some embodiments, a solenoid **110** may be used to actuate the electrical motor. In such embodiments, a switch **108** may be operatively connected to the solenoid **110**. In exemplary embodiments, an electric motor, a solenoid, and a switch may be operatively connected to each other by conventional electrical wiring **106**. In various embodiments, some of the wiring may be carried within a hollow interior **44** of the front arm assembly **40**.

In some embodiments, the output speed at which a motive source **112** rotates may exceed the rate at which a roll tube is normally rotated. In some embodiments, a motive source may be connected to a gear reducer (not shown). A speed reducing apparatus can effectively reduce the output speed of a motor so that it is compatible with the requirements a tarp cover. In some embodiments, a gear reducer may be combined with an electric motor as a single unit (for example, a Super Winch Power Drive Model No. 719627, available from Super Winch, Inc. of Putnam, Conn.). In some illustrative embodiments, a drive assembly **100** may be connected to an upper arm **42***a* of a front arm assembly **40**. In a preferred embodiment, a bracket **56** may be used to connect the drive assembly **100** to the upper arm **42***a*. Preferably, the bracket **56** positions the drive assembly **100** so that the output shaft (or drive shaft) **102** can be brought into alignment with the extended modified roll tube **20"**. In some embodiments, it may be desirable to modify the output of a combined motive source **112** and gear reducer such as the Super Winch Power Drive discussed above or equivalents thereof. In such instances, some embodiments may be provided with a gearbox **114** that includes an output shaft **102** that may be connected to an extension **46**. The gearbox **114** can be of many configurations. One preferred configuration is that disclosed in U.S. patent application Ser. No. 12/463,049, the disclosure of which is hereby incorporated herein by reference.

The first end **28***b* of the roll tube **20** is preferably equipped with a spline **94** such that once the conversion kit **38** is operatively installed, the rear arm assembly **82** can be operated with a hand crank arm **120** by removal of the clevis pin **60** as will be discussed in further detail below. It is likely that the tarp system **1** to be converted already includes a spline **94** for operation with a crank arm **120**. However, if an end of a roll tube **20** does not already have a spline **94**, a splined end similar to what is illustrated in FIG. **3** may be provided to the roll tube **20** in a retroactive manner. That is, an adaptor (not shown) may be outfitted with a splined end and then attached to one end of the roll tube **20**.

In some preferred embodiments, the lower arm **42***b* and the upper arm **42***a* of the front arm assembly **40** may have hollow interiors **44** that may serve as a storage area for electrical cords **106**. In even more preferred embodiments, the hollow interior **44** of the upper and lower arms may include a wear plate lining **74** that is made of a low-friction material to reduce wear on the electrical cords **106**. Examples of such preferred wear plate lining materials include nylon, high density polyethylene (HDPE), a combination thereof or the like.

The front arm assembly **40** preferably includes an upper end **42***a* telescopically connected to a lower end **42***b*. The front arm assembly **40** is preferably biased with a plurality of clock springs **138** in the unroll direction. The clock springs **138** are preferably attached to connecting portion **140**, which is secured to the front end F of the tractor trailer T with corresponding bracket **130** using conventional fastening elements such as nuts and bolts (not shown). The fastening elements are preferably arranged and configured such to allow the bracket **130** to be adjusted so as to accommodate slanted end walls (see, for example, FIGS. **10**B and **11**B). Preferably, the bracket **130** is positioned about 42-50 inches from the top of the trailer T. The bracket **130** may include a rod or post **136** on which the one or more clock springs **138** or the like can be secured. Preferably, bushings are secured around the rod **136** proximate where the rod is inserted through the connecting portion **140**. The clock spring(s) **138** can also be secured to a bolt **144** of the connecting portion **140** of the lower arm **42***b* such that the clock springs **138** bias the front arm assembly **40** in the unroll direction. In some illustrative embodiments, the connecting portion **140** may include a plurality of apertures **142** that are circumferentially spaced from each other, such that the bolt **144** can be positioned at different positions such that the amount of bias is adjustable. The connecting portion **140** can be sized such that the clock springs **138** are generally contained by the connecting portion **140** and the clock springs **138** will not move laterally along the rod **136**.

A preferred rear arm assembly **82** is largely similar to the front arm assembly **40** in that is may include an upper arm **84***a* telescopically connected to a lower arm **84***b*. However, the rear arm assembly **82** differs from the front arm assembly **40** in that it does not include a drive assembly **100** or a roll tube extension **46**. Instead, the rear arm assembly **82** has an upper arm **84***a* with a bracket **86** having an aperture **87**. Aperture **87** of the bracket **86**, which is used to connect the rear arm assembly **82** to an existing roll tube **20**, may include a friction-reducing element that facilitates rotation of the roll tube **20** relative to the rear arm assembly **82**. In some embodiments the friction-reducing element may comprise, for example, a roller bearing, a journal bearing, or a strip of low friction material such as high-density polyethylene (HDPE) or the like. In an illustrative embodiment, the bracket **86** may include one or more plates **88***a* and **88***b* having central apertures **89** that are sized to be congruent with the aperture **87** of bracket **86**. The apertures **89** of the plates **88***a*, **88***b* augment the surface area of the aperture **87** of the bracket **86** so that wear between the bracket **86** and the roll tube **20** can be reduced. In some embodiments, the apertures **89** of the plates **88***a*, **88***b* may also be provided with friction reducing elements. The conversion kit **38** may also include at least one collar **47** that can limit the amount of travel between the bracket **86** and the roll tube **20**. In some embodiments, a collar **47** may be provided with a set screw (not shown) that enables the collar **47** to be secured to a roll tube **20**. In preferred embodiments, the collar **47** is secured on the roll tube **20** to generally prevent the bracket **86** from moving significantly along the length of the roll tube **20** in an axial direction. In alternate embodiments, a second lock collar (not shown) can be secured on the roll tube proximate the spline **94**.

The preferred rear arm assembly **82** of the present invention includes an upper arm **84***a* telescopically connected to a lower arm **84***b*. The rear arm assembly **82** further includes a bracket **86** having inner and outer plates **88***a*, **88***b*. The bracket **86** and the inner and outer plates **88***a*, **88***b*, which may be connected to each other by one or more fastening elements such as nuts and bolts, include apertures that are concentrically aligned with each other and which are sized to rotatably receive a roll tube **20** or an extended modified roll tube **20"**. The apertures of the bracket **86** and plates **88***a*, **88***b* may be provided with one or more friction reducing elements to facilitate rotation of the roll tube **20** or an extended modified roll tube **20"**.

Identical to the front arm assembly **40**, the rear arm assembly **82** preferably includes an upper end **84***a* telescopically connected to a lower end **84***b*. The rear arm assembly **82** is preferably biased with a lower biasing member **138**. Biasing springs **138** are preferably connected to a connecting portion **140** that is secured to the front end F of the tractor trailer T with corresponding bracket **130** using conventional fastening elements such as nuts and bolts (not shown). The fastening elements are preferably arranged and configured such to allow the bracket **130** to be adjusted so as to accommodate slanted end walls (see, for example, FIGS. **10**B and **11**B). Preferably, the bracket **130** is positioned about 42-50 inches from the top of the trailer T. The bracket **130** may include a rod or post **136** on which one or more clock springs **138** or the like can be secured. Preferably, bushings are secured around the rod **136** proximate where the rod **136** is inserted through the connecting portion **140**. The clock spring(s) **138** can also be secured to a bolt **144** of the connecting portion **140** of the lower arm **42***b* such that the clock springs **138** bias the rear arm assembly **82** in the unroll direction. In some illustrative embodiments, the connecting portion **140** may include a plurality of apertures **142** that are circumferentially spaced from each other, such that the bolt **144** can be positioned at different positions such that the amount of biasing force is adjustable. The connecting portion **140** can be sized such that the clock springs **138** are generally contained by the connecting portion **140** and the clock springs **138** will not move laterally along the rod **136**.

Various preferred embodiments of the conversion kit **38** may include one or more bracing elements **150**. A brace element **150** may be used to reinforce a connection between a lower bracket assembly **130** and a wall of a truck T to which the lower bracket assembly **130** is secured. In some embodiments, a brace element **150** may be positioned against an inner surface of a truck wall (not shown) and secured with fastening elements (not shown) that are used to secure a lower bracket assembly **130** to the truck wall. In an illustrative embodiment, each brace element **150** may comprise a plate that includes slots **152** and apertures **154** that correspond to attachment slots **132** and apertures **134** of a lower bracket assembly **130**. It is noted that the bracket assemblies **130**, connecting portions **140** and brace elements **150** for the front arm assembly **40** and the rear arm assembly **82** are preferably identical and operate in a similar fashion.

It will be understood that front arm assembly **40** and rear arm assembly **82** can be interchangeable in that drive assembly **100** need not be constrained for installed only on the front end or cab C of the truck box T. It will be understood, however, that it is most common that a source of power P is located proximate the truck cab C and that it will typically be most desirable to install the conversion kit **38** having drive assembly **100** at the front. It is further believed that it is easiest to use a crank arm **120** when positioned at the rear of the truck box T.

In preferred embodiments, the connection between the output shaft **102** and the roll tube extension **46** will preferably feature two distinct modes of attachment that result in two distinct operational modes. In a first mode, output shaft **102** may be removably connectable to one end of the roll tube extension **46** such the output shaft **102** and the extension **46** rotate together. In the first mode of operation, the transverse

clevis pin **60** that extends through both the output shaft **102** and the set of two apertures **54** in the roll tube extension **46** proximate the first end segment **50** can be used to secure the output shaft **102** to the roll tube extension **46**. In a second mode, the output shaft **102** is rotatably retained by the extension **46**, so that the output shaft **102** may rotate freely or independently with respect to the extension **46** to which it is attached when the clevis pin **60** is not engaged with the output shaft **102** and the roll tube extension **46**. In the second mode of operation, the roll tube extension **46** includes a groove **58** that extends from a fully encircled opening **52** on one side of the roll tube extension **46** to a second fully encircled opening **52** on the opposite side, and cuts into the inner surface **51** that otherwise defines a hollow interior in the roll tube extension **46** to create the groove **58** that extends from one opening **52** to the other opening **52**. A first pin **64**, preferably a roll pin inserted into the fully encircled opening or pin aperture **52**, preferable engages both a portion of the peripheral groove **104** on the outer surface **101** of the output shaft **102** and a portion of inner groove **58** through the wall **59** of the roll tube extension **46** can be used to rotatably retain the roll tube extension **46** to the output shaft **102** in the second mode in which the roll tube extension **46** can freely rotate with respect to the output shaft **102**.

To install the conversion kit **38** of the present invention, it is preferred to first remove the tractor or cab C from the truck box T to provide better working space and also remove any existing returns such as cable return elastic cords or the like. Then, it is preferred to remove any U-clamps or other similar devices (not shown) that secure the flexible tarp **12** to the elongated roll tube **20**. Next, slide the roll tube **20** forward or rearward until the roll tube **20** will support the rear arm assembly **82**, which is under tension. The rear arm assembly can then be lifted so that the roll tube **20** and the aperture **87** of bracket **86** are aligned with the spline **94** and the roll tube **20** and the aperture **87** can then be slid onto the roll tube **20**. In various embodiments, collar **47** may be slid onto the roll tube before it is incorporated into the bracket **86**. In further preferred embodiments, plates **88***a*, **88***b* may be installed on either side of the bracket **86**. Plates **88***a*, **88***b* and bracket **86** can be secured together with fastening elements **91** such as nuts and bolts via apertures **89**. In further embodiments, a second collar **47** may be installed opposite the bracket **86** proximate the spline **94**.

For a trailer truck box T having a rear wall that is vertical, as illustrated in FIG. **11**A, it is preferred to align the respective arm assembly **82** with a vertical plane that is approximately 90 degrees relative to the extended modified roll tube **20"**. For a trailer truck box T having a rear wall that is slanted as is illustrated in FIG. **11**B, it is preferred to align the respective arm with a vertical plane that is approximately 90 degrees with respect to the roll tube **20**. In preferred embodiments, each arm assembly **40**, **82** is secured to a trailer truck T with a lower bracket assembly **130** using fastening elements such as nuts, bolts or the like (not shown).

Next, the roll tube extension **46** of the conversion kit **38** is secured to the output shaft (or drive shaft) **102** with a clevis pin or the like **60** and a cotter key or the like **62**. Then, a roll pin **64** may be installed by inserting it into a roll pin aperture **52** such that it is able to engage the groove **104** in the output or drive shaft **102**.

Alternatively, the steps of installing the clevis pin **60** and a roll pin **64** may be reversed, so that the roll pin **64** is installed before the clevis pin **60** is installed.

Then, hold the front arm assembly **40** up to the elongated roll tube **20** such that the arm joint is preferably at a 90 degree angle. Then, mark on the flexible tarp **12** the place where the end of the shoulder **49***b* of the roll tube extension **46** ends. Measure the distance "D" between the elongated roll tube **20** and the mark (see, FIGS. **10**A-**10**B and **12**). Then, at the rear, remove the plates **88***a*, **88***b* and rear arm **82** from the roll tube **20**. At the front, slide the roll tube **20** out of the tarp **12** loop and then shorten the roll tube **20** by the amount measured "D" in order to form a modified roll tube **20'**. Such shortening can be completed by cutting with a metal hack saw or the like.

Next, slide the second end segment **48** of the roll tube extension **46** into the modified roll tube **20'** and then, preferably, weld and grind the joint smooth to prevent unnecessary wear of the flexible tarp **12**. As will be understood, the end of the modified roll tube **20'** should be pulled away from the tarp **12** and the trailer T prior to welding to prevent damage of the tarp **12** and trailer T. Furthermore, a rust resistant paint (not shown) is preferably applied to the exposed metal after the welding and grinding processes.

Once the roll-tube extension **46** is operatively secured to the modified roll tube **20'** and finished, an extended modified roll tube **20"** and the extended modified roll tube **20"** can be pushed back into the tarp **12** loop. Then the output or drive shaft **102** can be attached to the roll tube extension **46** with a clevis pin **60** and cotter key **62** and the output shaft **102** can be checked to make sure it is in line with the roll tube extension **46** and extended modified roll tube **20"** and resides at an angle of about 90 degrees to the arm **40**. The clevis pin **60** can be inserted into both the aperture **54** of the roll tube extension **46** and the clevis pin aperture **103** in the output shaft **102** and then the cotter pin **62** can be used to secure the clevis pin **60** in position.

If the spline **94** is not already present in the existing tarp assembly **1**, at the rear end R of the trailer T, preferably the elongated roll tube **20** is trimmed proximate the outside plate **88***b* such that there is about 3 inches of roll tube **20** extending past the outside plate **88***b* when the rear arm **82** is positioned at a 90 degree angle with respect to the roll tube **20**. A spline **94** is then preferably secured to the recently trimmed end of the modified roll tube **20'**, proximate the outside plate **88***a*. The spline **94** is preferred for conversion kits intended to operate as both a motorized arm assembly and also a manual crank arm assembly.

To secure the rear arm **82**, slide the inside plate **88***b* onto the roll tube **20**, slide the spring arm **82** on and then slide the outside plate **88***a* on the roll tube **20**. The rear arm **82** is preferably adjusted so that the outside plate **88***a* is approximately 5 inches from the end of the modified roll tube **20'**. As noted above, the rear arm **82** is also preferably secured to the trailer T such that the rear arm **82** is approximately 90 degrees with respect to the modified roll tube **20'**. Finally, fastening elements **91** can be used to secure the inside and outside plates **88***a*, **88***b* to each other and the bracket **86**. Next, the flexible tarp **12** is reattached to the roll-tube **20** using, for example, the existing U-clamps and screws (not shown). Retighten any other bolts and nuts of the front and rear arm systems and tighten if needed.

Then, the cord **106** can be electrically connected to the power source P of the tractor trailer T. In preferred embodiments, the cords or wires **106** are mounted along the cab C.

Should the conversion kit **38** need to be operated manually, first let the extended modified roll tube **20"** hang down loose from the top of the trailer T. Then, remove the clevis pin **60** proximate the output shaft **102** and insert roll pin **64** at least partially within corresponding aperture **52**. Removal of the clevis pin **60** and insertion of the roll pin **64** will allow the extended modified roll tube **20"** to turn freely yet still be connected to the output shaft **102** of the drive assembly **100**. A crank handle **120** can be then attached at the rear end of the

extended modified roll tube **20"** to operate the assembly to open and close the flexible tarp **12** as needed. In preferred embodiments, the crank arm **120** includes a splined socket **122** that can engage the spline **94**. The splined socket **122** can be secured onto the spline **94** with a cotter pin assembly **124** or the like.

The present invention includes a number of preferred embodiments, including the following. A conversion kit **38** for converting a manually operated roll-up tarp assembly **1** to a motor driven roll-up tarp assembly; the manually operated roll-up tarp assembly including a flexible tarp **12** and a roll tube **20** upon which the flexible tarp **12** can be gathered and from which the flexible tarp **12** can be unfurled when the flexible tarp **12** is gathered upon the roll tube **20**; the roll tube **20** having a first length and first and second ends **28***b*, **28***a*. The conversion kit **38** preferably includes a first arm assembly **40** including a motor **100** having an output shaft **102**, wherein the output shaft **102** has an outer surface **101** and the outer surface **101** includes a first groove **104**; a first pin **64**; and a roll tube extension **46**; the roll tube extension **46** having first and second end segments **50**, **48** and an inner surface **51** that defines a hollow interior; the first end segment **50** being constructed and shaped so that it can slide onto the output shaft **102** to become connected therewith; wherein the roll tube **20** can be modified by removing a portion of the roll tube **20** proximate the second end **28***a* to form a modified roll tube **20'** that has a second length; wherein the second length is shorter than the first length; and wherein the second end segment **48** of the roll tube extension **46** is connectable to the modified roll tube **20'** so as to be an extension thereof and form an extended modified roll rube **20"**. The roll tube extension **46** preferably includes an inner surface **51** that defines a hollow interior proximate the first end segment **50** and the roll tube extension **46** further includes a first pin aperture **52** that can be aligned with the first groove **104** when the roll tube extension **46** is connected with the output shaft **102** such that the first pin can be inserted into the first pin aperture **52** and the first groove **104** such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be disengaged therefrom without removing the first pin **64**.

In other preferred embodiments, the conversion kit **38** will include a first arm assembly **40** including a motor **100** having an output shaft **102**, wherein the output shaft **102** has an outer surface **101** and the outer surface includes a first groove **104**; a first pin **64**; and a roll tube extension **46**; wherein the roll tube extension **46** has first and second end segments **50**, **48**; the first end segment **50** being shaped so that it can slide onto the output shaft **102** so as to become interconnected with the output shaft; wherein the roll tube can be modified by removing a portion of the roll tube **20** proximate the second end **28***a* to form a modified roll tube **20'** that has a second length; wherein the second length is shorter than the first length; and wherein the second end segment **48** of the roll tube extension **46** is connectable with the modified roll tube **20'** so as to become an extension thereof; wherein the roll tube extension **46** further includes an inner surface **51** that defines a hollow interior proximate the first end segment **50** and the roll tube extension **46** further includes a second groove **59** that extends into the inner surface **51** proximate the first end segment **50** such that the first pin **64** can reside at least partially in the first and second grooves **58**,**104** at the same time, when the respective first and second grooves **58**,**104** are aligned, such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be separated therefrom when the first pin **64** resides at least partially in the first and second grooves **58**,**104**.

In further preferred embodiments, the conversion kit **38** will further include a clevis pin **60**; the output shaft **102** will further include a clevis pin aperture **103**; and the roll tube extension **46** will further include a set of two second apertures **54** that can be aligned with the output shaft **102** in such a manner that the set of two second apertures **54** can receive the clevis pin **60** and the clevis pin **60** can pass through the clevis pin aperture **103** and both of the set of two second apertures **54** to secure the roll tube extension **46** to the output shaft **102** so that the extension roll tube **20'** will turn with the output shaft **102** when the clevis pin **60** is secured in the set of two of second apertures **54** and the clevis pin aperture **103**. In further preferred embodiments, the first aperture and the first pin **64** are sized in a manner that permits the first pin **64** to be force fit into the first aperture **52** in manner that prevents the first pin **64** from becoming disengaged therefrom without applying force to the first pin **64** to remove the first pin **64** from the first aperture **52**; wherein the roll tube extension **46** and the first pin **64** can rotate around the output shaft **102** independent thereof when the first pin **64** resides at least partially in the first groove **104**.

In certain preferred embodiments, the roll tube extension **46** further includes a second groove **58** that extends into an inner surface **51** of the roll tube extension **46** proximate the first end segment **50** such that the first pin **64** can be inserted into the first and second grooves **58**, **104** at the same time when the respective first and second grooves **58**, **104** are aligned, such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be separated therefrom when the first pin **64** resides in the first and second grooves **58**, **104**. In these embodiments, the first end segment **50** will preferably include a first pin aperture **52** that can be aligned with the first and second grooves **58**, **104**; wherein the first pin aperture **52** and the first pin **64** are preferably sized in a manner that permits the first pin **64** to be force fit into the first pin aperture **52** in manner that prevents the first pin **64** from becoming disengaged therefrom without applying force to the first pin **64** to remove the first pin **64** from the first pin aperture **52**; wherein the roll tube extension **46** and the first pin **64** can rotate around the output shaft **102** independently thereof when the first pin **64** resides at least partially in the first groove **58** and the first pin aperture **52**. In further embodiments, the first pin **64** is preferably a roll pin.

In other preferred embodiments, the roll tube extension **46** further includes a lubrication access port **35** in communication with the hollow interior **44** proximate one end segment **50** to permit the introduction of lubricants into the hollow interior **44**.

The lubricant access port **35** is preferably fitted with a zerk fitting **36**. In yet other preferred embodiments, the first arm assembly **40** includes an upper portion **42***a* and a lower portion **42***b* and the upper portion **42***a* has a generally hollow interior **44**, wherein the upper portion **42***a* is telescopically connected to the lower portion. In yet other preferred embodiments, the conversion kit **38** also includes a second arm assembly **82** interconnected to the second end **28***a* of the roll tube **20** and the back of the truck box T.

In yet other preferred embodiments, the conversion kit **38** for converting a manually operated roll-up tarp assembly **1** to a motor driven roll-up tarp assembly; the manually operated roll-up tarp assembly including a flexible tarp **12** and a roll tube **20** upon which the flexible tarp **12** can be gathered and from which the flexible tarp **12** can be unfurled when the flexible tarp **12** is gathered upon the roll tube **20**; the roll tube **20** having a first length and first and second ends **28***b*, **28***a*; the first end **28***b* including a splined connecting member **94**. The conversion kit **38** includes a first arm assembly including a

motor **100** having an output shaft **102**, wherein the output shaft **102** has an outer surface **101** and the outer surface **101** includes a first groove **104**; the output shaft **102** also including a clevis pin aperture **103**; a clevis pin **60**; a first pin **64**; a roll tube extension **46**; the roll tube extension **46** having first and second end segments **50**, **48** and one end segment **50** is shaped so that it can slide onto the output shaft **102**, so as to become interconnected with the output shaft **102**; wherein the roll tube **20** can be modified by removing a portion of the roll tube **20** proximate one end **28***a* to form a modified roll tube **20'** that has a second length; wherein the second length is shorter than the first length; and wherein one end segment **48** of the roll tube extension **46** is connectable with the modified roll tube **20'** so as to become an extension thereof. In these embodiments, the roll tube extension **46** preferably includes an inner surface **51** that defines a hollow interior one end segment **50**; and the roll tube extension **46** further includes a first pin aperture **52** can be aligned with the first groove **58** when the roll tube extension **46** is connected with the output shaft **102** such that the first pin **64** can be inserted into the first pin aperture **52** and the first groove **104** such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be disengaged therefrom without removing the first pin **64**. Preferably, the roll tube extension **46** further includes a second groove **58** that extends into the inner surface **51** through the roll tube extension **46** proximate the end segment **50** such that the first pin **64** can be inserted into the first and second grooves **58**, **104** at the same time when the respective first and second grooves **58**, **104** are aligned, such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be separated therefrom when the first pin **64** resides in the first and second grooves. The roll tube extension **46** may also include a set of two of apertures **54** that can be aligned with the output shaft **102** in such a manner that the set of two of apertures **54** can receive the clevis pin **60** that can secure the roll tube extension **46** to the output shaft **102** when the clevis pin **60** passes through the clevis pin aperture **103** and both of the set of two apertures **54** when the set of two apertures **54** are aligned with the clevis pin aperture **103**. The conversion kit **38** can also include a device **62** to maintain the clevis pin **60** within the set of two apertures **54**, preferably a cotter pin.

The present invention preferably includes a method of converting a manually operated roll-up tarp assembly **1** having a crank arm **120**, to a motor driven roll-up tarp assembly, wherein the manually operated roll-up tarp assembly **1** includes a flexible tarp **12** and a roll tube **20** upon which the flexible tarp **12** can be gathered and from which the flexible tarp **12** can be unfurled when the flexible tarp **12** is gathered upon the roll tube **20**; the roll tube **20** having a first length and first and second ends **28***b*, **28***a*; one end **28***a* including a splined connecting member **94**; and wherein the manually operated roll-up tarp assembly is installed on a truck box T. The method preferably includes the steps of: 1) providing a roll-up tarp conversion kit **38** including a first arm assembly **40** including a motor **100** having an output shaft **102**, wherein the output shaft **102** has an outer surface **101** and the outer surface **101** includes a groove **104**; a first pin **64**; and a roll tube extension **46** having first and second end segments **50**, **48** and an inner surface **51** that defines a hollow interior proximate one segment end **50**; the one end segment **50** being constructed and shaped so that the one end **50** can slide onto the output shaft **102** to become connected therewith; and wherein the roll tube extension **46** further includes a first pin aperture **52** that can be aligned with the groove **104** when the roll tube extension **46** is connected with the output shaft **102** such that the first pin **64** can be inserted into the first pin aperture **52** and the groove **104** such that the roll tube extension **46** is engaged with the output shaft **102** and cannot be disengaged therefrom, but wherein the roll tube extension **46** and the first pin **64** can rotate around the output shaft **102** independently thereof when the first pin **64** resides at least partially within the groove **104**; 2) making a predetermined measurement to determine a position along a greatest length of the roll tube **20** in which to cut the roll tube to remove a portion of the roll tube proximate one end so that a modified roll tube **20'** is created that has a second length that is shorter than the first length; 3) cutting the elongated roll tube **20** at the determined position to remove a portion of the roll tube **20** proximate the one end and create a modified roll tube **20'** that has a second length; and then, in no particular order; 4) securing one end segment of the roll tube extension **46** to the modified roll tube **20'** to form an extended modified roll tube **20"**; and 5) securing the first arm assembly **40** to the truck box T; 6) securing an end segment of the roll tube extension **46** to the output shaft **102**; and 7) inserting the first pin **64** into the first pin aperture **52** so that the first pin **64** resides at least partially within the first groove **104** so that the first pin **64** can prevent the roll tube extension **46** from disengaging from the output shaft **102** such that the roll tube extension **46** can rotate about the output shaft **102**.

In yet further preferred embodiments, the conversion kit further will include a clevis pin **60**, and the output shaft **102** will further include a clevis pin aperture **103** and the roll tube extension **46** will further include a set of two second apertures **54** that can be aligned with the output shaft **102** in such a manner that the set of two second apertures **54** can receive the clevis pin **60** and the clevis pin **60** can pass through both of the two second apertures **54** and the clevis pin aperture **103** to secure the roll tube extension **46** to the output shaft **102** so that the extension tube **46** will turn with the output shaft **102** when the clevis pin **60** is secured in the set of two of second apertures **54** and the clevis pin aperture **103**. In these other preferred embodiments, the method further will further include the step of inserting the clevis pin **60** into the set of two second apertures **54** and the clevis pin aperture **103** to further secure the roll tube extension **46** to the output shaft **102** so that the extension tube **46** will turn with the output shaft **102**.

In yet other preferred embodiments, where the manually operated roll-up tarp assembly includes a crank arm **120** and the crank arm from the manually operated roll-tarp assembly **1** is retained; the method further includes the step of removing the clevis pin **60** from the set of two second apertures **54** and the clevis pin aperture **103** to permit the roll tube extension **46** and the roll tube **20'** to freely rotate about the output shaft **102** independently of the output shaft **102** so that the crank arm **120** can be connected to the splined connecting member **94** on the end **50** so that the crank arm **94** can be used to manually turn the roll tube **20'** to either gather or unfurl the flexible tarp **12**.

In yet other preferred embodiments, the conversion kit **38** will further include a second arm assembly **82** and the method will preferably include, in no particular order with respect to the other steps, the step of securing the second arm assembly **82** to the truck box T and securing the second arm assembly **82** to the second end **28***b* of the roll tube **20** or modified roll tube **20'**.

Although the preferred embodiments of the present invention have been described herein, the above description is merely illustrative. Further modification of the invention herein disclosed will occur to those skilled in the respective arts and all such modifications are deemed to be within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A conversion kit for converting a manually operated roll-up tarp assembly to a motorized roll-up tarp assembly that can be manually operated with a hand crank arm; the manually operated roll-up tarp assembly including a flexible tarp, a roll tube, upon which the flexible tarp can be gathered and from which the flexible tarp can be unfurled when the flexible tarp is gathered upon the roll tube, and a rear arm assembly; the roll tube having a first length and first and second ends; the conversion kit comprising:

a first arm assembly including a motor having an output shaft;

a first pin; and

a roll tube extension; the roll tube extension having first and second end segments; the first end segment being constructed and shaped so that the first end segment can slide onto the output shaft to become connected therewith; wherein the roll tube can be modified by removing a portion of the roll tube proximate the second end to form a modified roll tube that has a second length; wherein the second length is shorter than the first length; and wherein the second end segment of the roll tube extension is connectable to the modified roll tube so as to be an extension thereof and part of an extended modified roll tube;

wherein the roll tube extension includes an inner surface that defines a hollow interior proximate the first end segment; the output shaft includes a first groove and the roll tube extension further includes a first pin aperture, such that the first pin can be inserted into the first pin aperture and the first groove when the output shaft resides in the hollow interior;

wherein the roll tube extension will be engaged with the output shaft when the output shaft resides in the hollow interior and the first pin is inserted in the first pin aperture and the first groove, such that the roll tube extension will remain engaged with the output shaft but rotate freely with respect to the output shaft, so that the extended modified roll tube can be turned by the hand crank arm.

2. The conversion kit of claim 1, wherein the output shaft has an outer surface and the outer surface includes the first groove, wherein the output shaft further includes a second pin aperture and the roll tube extension further includes a set of two second apertures that can be aligned with the output shaft in such a manner that the set of two second apertures can receive a second pin and the second pin can pass through the second pin aperture and both of the set of two second apertures to secure the roll tube extension to the output shaft so that the roll tube extension will turn with the output shaft when the second pin is secured in the set of two second apertures and the second pin aperture; and wherein the extended modified roll tube can be turned by the hand crank arm to roll and unroll the flexible tarp on the extended modified roll tube if the second pin is removed from the set of two second apertures and the second pin aperture.

3. The conversion kit of claim 1, wherein the second pin is a clevis pin.

4. The conversion kit of claim 1, wherein the output shaft has an outer surface and the outer surface includes the first groove, wherein the first aperture and the first pin are sized in a manner that permits the first pin to be force fit into the first aperture in manner that prevents the first pin from becoming disengaged therefrom without applying force to the first pin to remove the first pin from the first aperture; wherein the roll tube extension and the first pin can rotate around the output shaft independent thereof when the first pin resides at least partially in the first groove.

5. The conversion kit of claim 4, wherein the roll tube extension further includes a lubrication access port in communication with the hollow interior proximate the first end segment to permit the introduction of lubricants into the hollow interior; wherein the lubricant access port is fitted with a zerk fitting.

6. The conversion kit of claim 4, wherein the roll tube extension further includes a second groove that extends into the inner surface of the roll tube extension proximate the first end segment such that the first pin can be inserted into the first and second grooves at the same time when the respective first and second grooves are aligned, such that the roll tube extension is engaged with the output shaft and cannot be separated therefrom when the first pin resides in the first and second grooves.

7. The conversion kit of claim 1, wherein the output shaft of the motor has an outer surface and the outer surface includes a first groove in which the first pin can reside when the roll tube extension is engaged with the output shaft.

8. The conversion kit of claim 1, wherein the first arm assembly includes an upper portion and a lower portion and the upper portion has a generally hollow interior and the upper portion is telescopically connected to the lower portion.

9. The conversion kit of claim 8, wherein the first pin is a roll pin.

10. A conversion kit for converting a manually operated roll-up tarp assembly to a motor driven roll-up tarp assembly that can also be operated with a hand crank arm; the manually operated roll-up tarp assembly including a flexible tarp, a roll tube, upon which the flexible tarp can be gathered and from which the flexible tarp can be unfurled when the flexible tarp is gathered upon the roll tube, and a rear arm assembly; the roll tube having a first length and first and second ends; the conversion kit comprising:

a first arm assembly including a motor having an output shaft, wherein the output shaft has an outer surface and the outer surface includes a first groove;

a first pin; and

a roll tube extension; the roll tube extension having first and second end segments; the first end segment being shaped so that it can slide onto the output shaft so as to become interconnected with the output shaft; wherein the roll tube can be modified by removing a portion of the roll tube proximate the second end to form a modified roll tube that has a second length; wherein the second length is shorter than the first length; and wherein the second end segment of the roll tube extension is connectable with the modified roll tube so as to form an extended modified roll tube and become an extension of the modified roll tube; wherein the roll tube extension further includes an inner surface that defines a generally hollow interior proximate the first end segment and the roll tube extension further includes a second groove that extends into the inner surface proximate the first end segment such that the first pin can reside at least partially in the first and second grooves at the same time when the respective first and second grooves are aligned such that the roll tube extension is engaged with the output shaft when the first pin resides at least partially in the first and second grooves;

wherein the output shaft further includes a second pin aperture; and wherein the roll tube extension further includes a set of two second apertures that can be aligned with the output shaft in such a manner that the set of two

second apertures can at least partially receive a second pin and the second pin can pass through the second pin aperture and both of the set of two second apertures to secure the roll tube extension to the output shaft so that the roll tube extension will turn with the output shaft when the second pin is secured in the set of two of second apertures and the second pin aperture; but removing the second pin will permit the hand crank arm to turn the extended modified roll tube so as to roll and unroll the flexible tarp on the extended modified roll tube.

11. The conversion kit of claim **10**, wherein the second pin is a clevis pin.

12. The conversion kit of claim **10**, wherein the first end segment includes a first pin aperture that can be aligned with the first and second grooves; wherein the first pin aperture and the first pin are sized in a manner that permits the first pin to be force fit into the first pin aperture in manner that prevents the first pin from becoming disengaged therefrom without applying force to the first pin to remove the first pin from the first pin aperture; wherein the roll tube extension and the first pin can rotate around the output shaft independently thereof when the first pin resides at least partially in the first groove and the first pin aperture.

13. The conversion kit of claim **12**, wherein the roll tube extension further includes a lubrication access port in communication with the hollow interior proximate the first end segment to permit the introduction of lubricants into the hollow interior.

14. The conversion kit of claim **13**, wherein the lubricant access port is fitted with a zerk fitting.

15. The conversion kit of claim **10**, wherein the first arm assembly includes an upper portion and a lower portion and the upper portion has a generally hollow interior, wherein the upper portion is telescopically connected to the lower portion.

16. The conversion kit of claim **10**, wherein the first pin is a roll pin.

17. A method of converting a manually operated roll-up tarp assembly having a rear arm assembly including a hand crank arm, to a motor driven roll-up tarp assembly, the manually operated roll-up tarp assembly including a flexible tarp and a roll tube upon which the flexible tarp can be gathered and from which the flexible tarp can be unfurled when the flexible tarp is gathered upon the roll tube; the roll tube having a first length and first and second ends; the first end including a splined connecting member; wherein the manually operated roll-up tarp assembly is installed on a truck box; the method comprising the steps of:

1) providing a roll-up tarp conversion kit including: a first arm assembly including a motor having an output shaft, wherein the output shaft has an outer surface and the outer surface includes a groove; a first pin; and a roll tube extension having first and second end segments and an inner surface that defines a hollow interior proximate the first end segment; the first end segment being constructed and shaped so that the first end segment can slide onto the output shaft to become connected therewith; wherein the roll tube extension further includes a first pin aperture that can be aligned with the groove when the roll tube extension is connected with the output shaft such that the first pin can be inserted into the first pin aperture and the groove such that the roll tube extension is engaged with the output shaft and cannot be disengaged therefrom, but wherein the roll tube extension and the first pin can rotate around the output shaft independently thereof when the first pin resides at least partially within the groove;
2) making a predetermined measurement to determine a position along a greatest length of the roll tube in which to cut the roll tube to remove a portion of the roll tube proximate the second end so that a modified roll tube can be created by removing the selected portion of the roll tube so that the modified roll tube has a second length that is shorter than the first length;
3) cutting the roll tube at the determined position so as to remove the selected portion of the roll tube proximate the second end and create a modified roll tube that has the second length; and, in no particular order;
4) securing the second end segment of the roll tube extension to the modified roll tube to form an extended modified roll tube;
5) securing the first arm assembly to the truck box;
6) securing the first end segment of the roll tube extension to the output shaft; and
7) inserting the first pin into the first pin aperture so that the first pin resides at least partially within the first groove so that the first pin can prevent the roll tube extension from disengaging from the output shaft, but such that the roll tube extension can rotate about the output shaft.

18. The method of claim **17**, wherein the conversion kit further includes a second pin, the output shaft further includes a second pin aperture and the roll tube extension further includes a set of two second apertures that can be aligned with the output shaft in such a manner that the set of two second apertures can receive the second pin and the second pin can pass through both of the two second apertures and the second pin aperture to secure the roll tube extension to the output shaft so that the extension tube will turn with the output shaft when the second pin is secured in the set of two of second apertures and the second pin aperture; and wherein said method further comprises the step of:

inserting the second pin into the set of two second apertures and the second pin aperture to further secure the roll tube extension to the output shaft so that the extended modified roll tube will turn with the output shaft; wherein the extended modified roll tube can be turned with the hand crank arm independent of the output shaft if the second pin is removed from the second pin aperture and the set of two second apertures.

19. The method of claim **18**, wherein the method further comprises the step of removing the second pin from the set of two second apertures and the second pin aperture to permit the extended modified roll tube to freely rotate about the output shaft independently of the output shaft so that the hand crank arm can be connected to the splined connecting member of the first end so that the hand crank arm can be used to manually turn the extended modified roll tube to either gather or unfurl the flexible tarp without turning the output shaft.

20. The method of claim **17**, wherein the conversion kit further includes a second arm assembly and said method further comprises, in no particular order, the steps of securing the second arm assembly to the truck box and securing the second arm assembly to the first end of the roll tube.

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